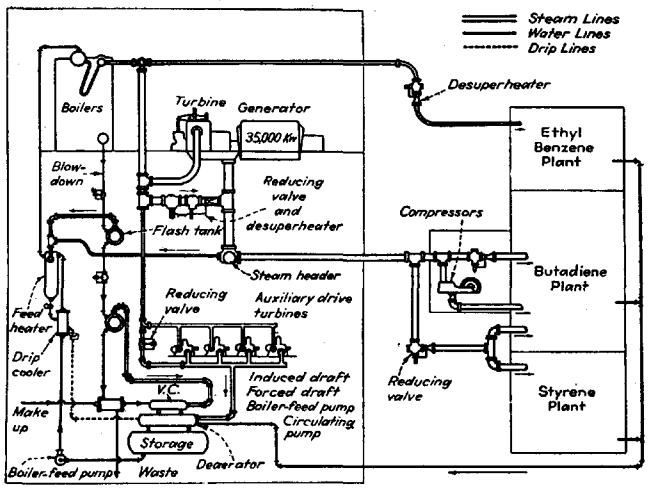
Steam and Synthetic Rubber

By YVONNE LAMOREAUX, E.E. II

WITH the increase in the manufacture of butadiene and styrene synthetic rubbers, new plants are being designed and constructed employing steam as a source of power, heat, and refrigeration.

In using steam in the butadiene industry, it is necessary to bring many things into consideration. Steam for the production of butadiene and styrene is needed at pressures varying from 75 psi. to 725 psi. By generating steam from 600 to 1200 psi., however, and expanding it through a steam turbine generator to provide electrical energy, by driving the compressor to provide refrigeration, and by providing heat for the process, the steam was made to perform a triple



—Courtesy Westinghouse.

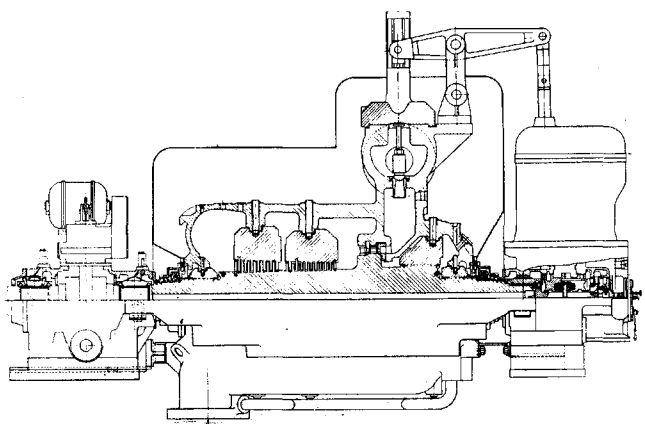
Diagrammatic Sketch Showing Steam Flow

duty. The higher the boiler pressure, the greater the output of by-product power from the turbine generator unit. By using a moderate temperature, the use of many critical metals could be avoided in such parts as boiler super-heater, turbine casing, steam chest, throttle valve, and steam piping. High steam pressure, however, would permit the use of a standard design of turbine, while low steam pressures require abnormally large pipes and steam passages. Considering all these factors, a highly satisfactory system has been designed and set up.

A continuous supply of steam is assured by reducing valve stations with desuperheaters installed in parallel with the main turbine which permit 725 psi. of steam to pass directly to the exhaust. The system is designed both to supply the necessary heat and steam for the process and to dispose of impurities which collect in the drums. To prevent accumulation in the boiler drums of soluble salts, which carry over in the steam as a result of excess concentration, part of the boiler water is blown down. A portion of this water goes to a high-pressure flash tank, which is maintained at the same pressure as the exhaust of the turbine generator unit. This vapor is used partially to heat the boiler feed. Part of the remaining blow-down is lead to a low pressure flash tank where additional water is flashed into steam and admitted to the de-aerating heater. The remainder gives up heat to the incoming boiler feed.

The boiler feed passes through the exchange heater to the de-aerating heater where it is heated to approximately 240°F. After being thoroughly de-aerated, it enters the boiler feed pumps. Here, to allow for variations in steam flow and water flow, a storage tank is incorporated. Following this, the feed is passed through a drain cooler and into a high pressure heater which raises the temperature to 363°F. before entering the boiler.

Obviously, the heat from the boiler blow-down will not be sufficient to heat the boiler feed water.



—Courtesy Westinghouse.

Longitudinal Half-Section of Non-Condensing Turbine

Additional steam is obtained from the exhaust of the power house auxiliary drives. Fourteen auxiliaries, including the boiler feed pump, are driven by steam turbines. The auxiliaries require 7600 hp of general purpose turbines. Steam from these turbines may be obtained either from the main header, or from the exhaust of the

(Continued on page 22)

STEAM AND SYNTHETIC RUBBER

(Continued from page 11)

main turbine generator unit. Since header pressure steam results in excess pressure for the de-aerater, it is employed largely for the auxiliary drive. Only under certain conditions is it necessary to make up for any deficiency. This deficiency is taken care of by bringing steam directly from the exhaust of the turbine generator.

The steam pressure supplying the process and high-pressure heater is maintained by means of an exhaust pressure regulator on the turbine. This device controls the steam flow through the turbine, maintaining the desired pressure. Reducing valves maintain the supply to the de-aerator. Steam is supplied to the butadiene plant through a combination reducing valve and de-superheating station.

The excess of electrical power generated by the main turbine has been distributed by a local utility. To guarantee continuous functioning of the utility in case of an interruption of the tie-line between the utility and the turbine generator unit, the exhaust pressure can be rendered unoperative, and the turbine speed governor will take over and maintain the frequency. In case of a complete shutdown, the utility will supply power through an interconnection.

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